

Remarks

The above amendments and these remarks are responsive to the Office Action mailed August 9, 2005. With entry of this amendment, claims 1-39 are pending. No new matter has been added by these amendments.

Applicants thank the Examiner for carefully considering the subject application.

Rejections under 35 USC § 103

Before discussing the Office action in detail, Applicants believe it may be helpful to review some background information. As noted in Applicants' specification, various methods may be used to control valves during engine operation. However, in the case where a valve may become degraded, such approaches may provide an incorrect engine output. To address such a situation, the cylinder (or cylinders) having a degraded valve are deactivated. This appears to be in line with the approaches of Sono et al. (U.S. 5,765,514) or Di Lieto et al. (U.S. 6,390,038), which will be discussed in more detail below.

Applicants, however, have taken a different approach, such as outlined in claim 1, which provides:

A method for operating an internal combustion engine with electrically actuated valves, the method comprising:
operating at least a cylinder in a multi-stroke mode; and
adjusting at least a number of valves that operate in a cycle of said cylinder based at least on an operating condition of at least an electrically actuated valve, where at least one valve operates to open and close in said cycle so that said cylinder operates with said adjusted number of valves.

In this way, a cylinder with multiple intake and/or exhaust valves operating in a multi-stroke mode with a degraded intake and/or exhaust valve may be able to deactivate the degraded valve; yet continue to operate and provide a desired torque. For example, by determining the

number of valves operating in a cylinder based on a valve operating condition, the timing of operating valves may be adjusted to compensate for deactivating a degraded valve. Thus, the entire cylinder is not deactivated, but continues to operate with operating valves.

The approach of claim 1 (and other claims), however, is not limited to simply solving problems of degraded valve conditions. Rather, additional advantages may also be achieved. For example, by matching the number of operating valves in a cylinder to valve operating conditions, engine torque resolution may be improved. In other words, since engine torque may be determined, in part, by airflow into a cylinder, and since cylinder airflow may be dependant on the number of operating valves in a cylinder, selecting an appropriate number of valves to operate in a cylinder may permit finer control of engine torque, which can be especially advantages when operating in a multi-stroke mode where cylinder torque pulses may be less frequent in time.

Thus, in one example, by determining an operating condition of an electrically actuated valve and using said operating condition as a factor to determine the number of valves to operate in a cylinder, electrically actuated valve based multi-stroke engine operation may be improved

Turning now to the Office action, it first rejects claims 1, 7, 9, 11, 16, 18-20, 26, 28-30, 32, 35, and 37-39 under 35 U.S.C 103(a) as being unpatentable over Matsumoto et al. (US Pat. No. 6332446) in view of Sono et al. (US Pat. No. 5,765,514). Likewise, claims 1-39 were rejected under in view of Matsumoto et al. in view of Di Lieto et al. (U.S. 6,390,038). Applicants respectfully disagree since the cited references admittedly focus on deactivating cylinders, rather than continuing cylinder operation as in the present application.

Specifically, as noted by the Office action at page 2, the approach of Matsumoto et al. is directed toward deactivating cylinders:

Matsumoto et al teaches an internal combustion engine having
electromagnetically controlled valves which may operate in a multi-stroke mode and in which
certain cylinders may be deactivated.

Likewise, the Office action (at page 3) also notes that the approach of Sono et al. also shuts off cylinders and deactivates a cylinder when valve degradation is identified:

Sono et al teach an engine having electromagnetically controlled
valves wherein when an abnormal condition exists in one of the electromagnetically actuated
valves, the valves of that cylinder are shut off and the cylinder is deactivated.

Continuing with the remaining reference (Di Lieto et al.) cited in the Office action at page 3, its approach also appears to be based on the convention wisdom that:

when an abnormal condition exists in one
of the electromagnetically actuated valves, the valves of that cylinder are shut off and the
cylinder is deactivated.

Counter to the cited teachings of every cited reference, the approach of claim 1 adjusts a number of valves that operate in a cycle of a cylinder based at least on an operating condition of an electrically actuated valve, where at least one valve operates to open and close in said cycle so that said cylinder operates with said adjusted number of valves. In other words, rather than deactivate a cylinder as taught in the cited art, the cylinder continues to operate with at least one valve opening and closing. In this way, various advantages may be achieved, as noted above. Thus, not only do the cited references fail to disclose the features of claim 1, but they teach away from such features.



In view of the fact that the cited art teaches away from the approach of claim 1, Applicants respectfully request that the rejections of claim 1 be withdrawn.

Therefore, as described above, the cited art does not disclose each and every element of independent claims 1 from which claims 2 - 6 depend. Furthermore, the above arguments apply to independent claims 7, 11, 16, 20, 26, 30, 35, and 39 as amended.

As such, Applicants respectfully request the rejection of claims 1 – 39 to be withdrawn for at least the reasons described above.

Based on the foregoing comments, the above-identified application is believed to be in condition for allowance, and such allowance is courteously solicited. If any further amendment is necessary to advance prosecution and place this case in allowable condition, the Examiner is respectfully requested to contact the undersigned by fax or telephone at the number listed below.

Please charge any cost incurred in the filing of this Amendment, along with any other costs, to Deposit Account No.06-1510. If there are insufficient funds in this account, please charge the fees to Deposit Account No. 06-1505. A duplicate copy of this sheet is enclosed.

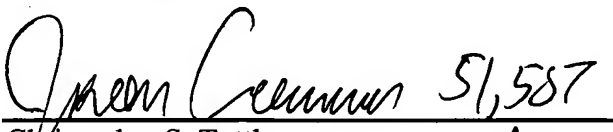
CERTIFICATE OF MAILING

I hereby certify that this correspondence is being sent via first class mail addressed to Mail Stop AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on November 9, 2005


Lauren Barberena

Respectfully submitted,

ALLEMAN HALL MCCOY RUSSELL & TUTTLE LLP


Christopher S. Tuttle
Registration No. 41,357
Customer No. 36865
of Attorneys for Applicants
806 SW Broadway, Suite 600
Portland, Oregon 97205
Telephone: (503) 459-4141
Facsimile: (503) 295-6679